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REPORT
OF
SCHOOL OF MINES AND METALLURGY,
AT
ROLLA, PHELPS COUNTY, MO.,
1886-
For the Year Ending June 9, 1887.

[FROM THE MISSOURI UNIVERSITY CATALOGUE, 1886-7.]

FEB 24 1887

1886-7

REPORT

OF

SCHOOL OF MINES AND METALLURGY,

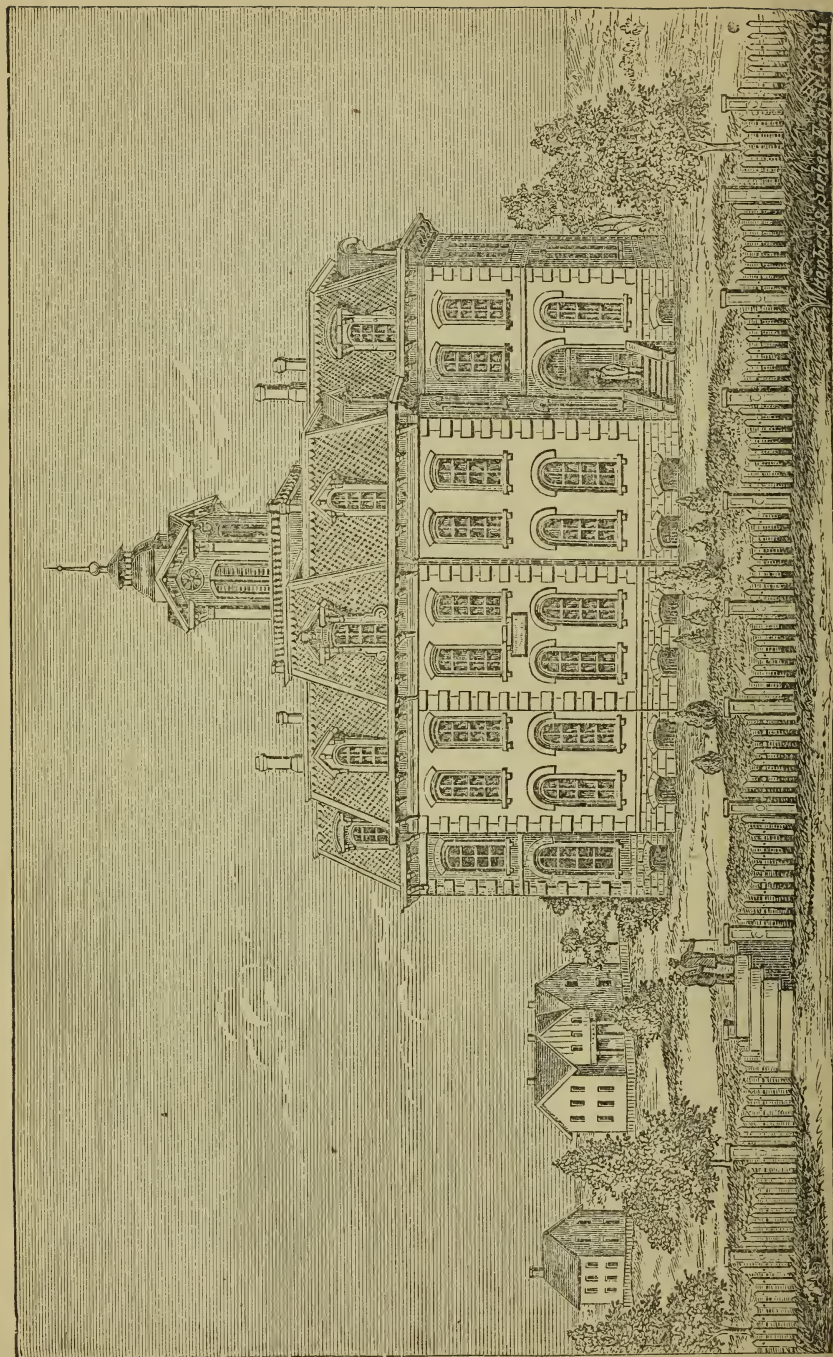
AT

ROLLA, PHELPS COUNTY, MO.,

For the Year Ending June 9, 1887

[FROM THE MISSOURI UNIVERSITY CATALOGUE, 1896-7.]

JEFFERSON CITY:
TRIBUNE PRINTING COMPANY, STATE PRINTERS AND BINDERS.
1887.



MAIN COLLEGE BUILDING.

MISSOURI UNIVERSITY

SCHOOL OF MINES AND METALLURGY,

ROLLA, PHELPS COUNTY, MO.

REPORT FOR THE YEAR ENDING JUNE 9TH, 1887.

BOARD OF CURATORS.

JOHN S. CLARKSON, A. M.....	Columbia..	} Term expires Jan. 1, 1889.
JERRE C. CRAVENS, ESQ.....	Springfield.	
DEWITT CLINTON ALLEN, ESQ.....	Liberty....	
EDWIN W. STEPHENS, A. M.....	Columbia..	} Term expires Jan. 1, 1891.
JAMES R. ESTILL.....	Howard Co.	
JOSEPH CAMPBELL	Rolla.....	
J. S. MOSS, ESQ.....	Columbia..	} Term expires Jan. 1, 1893.
CHARLES C. BLAND, ESQ	Rolla	
NORMAN J. COLMAN, U. S. Com. Ag....	St. Louis...	

OFFICERS OF THE BOARD.

EDWIN W. STEPHENS, A. M.....	President.
JERRE C. CRAVENS, ESQ.....	Vice-President.
J. H. DRUMMOND,	ROBERT BEVERLY PRICE,
Secretary.	Treasurer.

SCHOOL OF MINES.

EXECUTIV COMMITTEE.

JUDGE CHARLES C. BLAND, Chairman.....	Rolla.
JOSEPH CAMPBELL.....	Rolla.
JERRE C. CRAVENS, ESQ.....	Springfield.
D. W. MALCOLM, Treasurer.....	Office at Rolla.
HENRY WOOD, Secretary Executive Committee.	

FACULTY.

SAMUEL S. LAWS, LL. D.,
President.

CHAS. E. WAIT, C. E., M. E., (Director),
Professor of Analytical Chemistry and Metallurgy.

† MAJOR GEO. D. EMERSON, M. E.,
Special Lecturer on Mine Engineering.

‡
Professor of Civil and Mine Engineering and Graphics.
(To be supplied.)

E. DE W. EATON, M. S., C. E.,
Professor of Mathematics.

W. G. CLARK, B. S., (C. E.),
Assistant in Mathematics and Chemistry and Secretary of the Faculty.

E. A. DRAKE, A. B.,
Instructor in English Branches.

W. G. CLARK,
Librarian.

GRADUATES.

Duncan, Gustavus H., C. E.....1874Boulder, Col.
*Gill, John H., C. E.....1874: U. S. Eng. Dep., Washington D. C.
Pack, John W., M. E.....1874 Assayer, Helena, Montana.
Deegan, Francis J., C. E.....1875Eng. on St. L. & San Francisco R. R.
Hare, Almon W., M. E.....1875Leadville, Col.
Emerson, Cyrus H., C. E.....1876Denison, Texas.

*Deceased. †For 1886-7. ‡The work during the past year was in charge of Mr. Clark.

Garvens, Oscar E., M. E.....	1876	.....	Lead City, Dakota Ter.
Greason, John D., M. E.....	1876	.....	Druggist, Ironton, Mo.
McGrath, John D., C. E.....	1876	.....	U. S. Coast Survey.
Minger, William C., M. E.....	1876	.....	Boulder, Col.
Ohmann-Dumesnil, A., H. M. E.....	1877	.....	M. D., St. Louis.
Pack, James A., M. E.....	1877	.....	Assayer, Butte City, Montana.
*Milsaps, Thomas H., C. E.....	1877		
Brown, Wilton R., M. E.....	1878	{	Assayer of Shakespeare Gold and Silver Min. Co., Shakespeare, Grant county, New Mexico.
Grabill, Lee R., M. E.....	1878	.....	Assayer, New Mexico.
Bean, William Y., C. E.....	1878	.....	Engineer, Missouri Pacific R. R.
*Coppedge, Lindsay L., C. E.....	1878	.....	Engineer, Missouri Pacific R. R.
Winters, Chas. F., M. E.....	1879	.....	Assayer, New Mexico.
Hoyer, Rudolph C., C. E.....	1879	.....	U. S. Eng. Dep., City of Mexico.
Carson, Arthur C., M. E.....	1880	.....	Assayer, Butte City, Montana.
Smith, Lorin X., M. E.....	1880	...	Mining Engineer, Silver City, N. M.
Smith, Lorin X., C. E.....	1881	....	" " " " " "
Summers, Edward B.....	1881	.....	Engineer, U. S. Topog. Survey.
Wishon, Walter, W.....	1881	....	Colorado Springs, Col.
Gibb, Frank W., C. E., M. E.....	1882	....	Mining Engineer, Little Rock, Ark.
Painter, W. R., C. E.....	1882	.....	County Surveyor, Moberly, Mo.
Schrantz, A. B., C. E.....	1882	.....	Engineer, U. P. R. R.
Van Devander, H. N., C. E.....	1882	.....	Engineer, Frisco Railway.
Ross, B., M. E.....	1882	....	Houston, Mo.
Davis, Floyd, C. E., M. E., Ph. B....	1883	{	Professor of Assaying and Metallurgy, Dak. School of Mines, Rapids City, Dakota, Ter.
Alexander, Curtis, C. E., M. E.....	1884	.....	Maryville, Mo.
Claypool, W. M., C. E., M. E.....	1884	.....	Chemist, Fairbank, Ariz. Ter.
Gallaher, P. C., M. E.....	1884	.....	Assayer, Leadville.
Neustaedter, A., M. E.....	1884	....	Assayer and Chemist, Belleville, Ill.
Wilson, Frank, C. E.....	1884	.....	Engineer, Frisco Railway.
Owen, J. R. D., M. E.....	1885	..	Chemical Laboratory, School of Mines.
Van Frank, Phil. R., M. E.....	1885	.....	Engineer, Mo. P. R. R.
Wilson, Fremont, C. E.....	1885	.....	Eng., St. L., K. C. & Col. R. R.
Martinez, J. G., M. E.....	1886	.....	Ass't Chemist, Coahuilo, Mexico.
Cullings, Jay, C. E.....	1886	.....	Eng., U. P. R. R.
Fulcher, Jas. E., C. E.....	1886	.....	R. R. Mail Clerk, St. L. & S. F. Ry.

COURSES OF STUDY.

The work of the school is done in two departments: Academic and Technical.

* Deceased.

ACADEMIC DEPARTMENT.

At the last session of the Legislature of Missouri, a bill was passed providing for the establishment of an academic course of study at the School of Mines. In pursuance of the provisions of this act the Faculty of the School of Mines, at their first meeting in September, arranged the following course, which has since been duly approved by the Executive Committee of the School :

COURSE OF STUDY.

FIRST TERM.	SECOND TERM.
<i>First Year:</i> Arithmetic.	Algebra, (c).
Grammar and Word Analysis.	Composition and Rhetoric.
U. S. History.	Physical Geography.
Drawing, (d).	Physiology.
	Drawing, (c).
FIRST TERM.	SECOND TERM.
<i>Second Year:</i> Latin, (d).	Latin, (c).
Algebra, (b).	Algebra, (a).
Geometry, (b).	Geometry, (a).
Physics.	Civil Government.
Drawing, (b).	Drawing, (a).
FIRST TERM.	SECOND TERM.
<i>Third Year:</i> Latin, (b).	Latin, (a).
Trigonometry.	Land Surveying, or Botany.
English Literature.	Chemistry.
Book-keeping.	Political Economy.

Rhetorical exercises (compositions, readings, etc.) weekly throughout the entire course.

Upon the satisfactory completion of this course a diploma will be granted.

The text-books, not mentioned elsewhere, used in the Academic Course are David J. Hill's Elements of Rhetoric and Composition, Guyot's Physical Geography, Steele's Physiology, Townsend's Analysis of Civil Government, Shaw's History of English and American Literature, Rohrer's Book-keeping, Gray's Botany, Wayland's Political Economy; in Latin, Dr. Smith's *Principia Latina*, Allen and Greenough's Cæsar (four books), Allen and Greenough's Virgil (four books of the *Æneid*).

This course is designed for the benefit of those students who do not wish to enter the Technical Department, and who still wish to complete a more extended course of studies than is offered in the Preparatory. It is believed that the course will especially commend itself to young men who wish to fit themselves for successful business pursuits, and to teachers who wish to prepare for the higher work of their profession.

While the time devoted to this course is short, much will be gained by the necessary concentration of attention and effort. It is designed to make the course equal in every respect to those offered at the best Academies in the West. The instruction given is of the best; and, while the amount of work required is not beyond the capacity of the average student, that degree of application is expected without which the best results in way of intellectual training cannot be secured.

PREPARATORY COURSE.

This course is still maintained for the benefit of those who may wish to prepare themselves for the work in the Technical Department.

COURSE OF STUDY.

FIRST YEAR.

FIRST TERM.

Arithmetic.
Grammar and Word Analysis.
U. S. History.
Drawing (d).

SECOND TERM.

Algebra (c).
Composition and Rhetoric.
Physical Geography.
Drawing (c).

SECOND YEAR.

FIRST TERM.

Algebra (b).
Geometry (b) Plane.
Physics (b).
Drawing (b).

SECOND TERM.

Algebra (a).
Geometry (a).
Chemistry.
Physics (a).
Drawing (a).

Rhetorical exercises (compositions, readings, etc.,) weekly throughout the entire course.

The satisfactory completion of this course shall admit to the Technical Department without further examination, and shall also entitle the student to a certificate, should he desire it, showing the studies pursued and the grade in each.

TECHNICAL DEPARTMENT.

Candidates for admission will be examined in all the studies of the Preparatory Course.

COURSE OF STUDY:

For the Degree of Mining Engineer.

FIRST TERM.

SECOND TERM.

First Year : Chemical Philosophy.
Blowpipe Analysis.
Trigonometry.
Drawing.

Chemical Technology.
Qualitative Analysis.
Descriptive Geometry.
Analytic Geometry.
Drawing.

FIRST TERM.

SECOND TERM.

Second Year : Quantitative Analysis.
Metallurgy.
Differential Calculus.
Surveying.
Shades, Shadows and Perspective.
Determinative Mineralogy.
Geology.

Quantitative Analysis.
Metallurgy.
Mine Engineering.
Integral Calculus.
Steam Engine.
Assaying.

FIRST TERM.

SECOND TERM.

Third Year : Quantitative Analysis.
Metallurgy.
Analytic Mechanics.

Quantitative Analysis.
Graduation Thesis.

FOR THE DEGREE OF CIVIL ENGINEER.

FIRST TERM.

SECOND TERM.

First Year : Chemical Philosophy.
Blowpipe Analysis.
Trigonometry.
Drawing.

Chemical Technology.
Qualitative Analysis.
Descriptive Geometry.
Analytic Geometry.
Drawing.

FIRST TERM.

SECOND TERM.

Second Year : Roads and Railroads, etc.
Surveying.
Differential Calculus.
Shades, Shadows and Perspective.
Astronomy.
Geology.

Surveying.
Steam Engine.
Integral Calculus.
Civil Engineering.
Assaying.

FIRST TERM.

Third Year: Railroad Location.
 Mechanism.
 Analytic Mechanics.
 C. E. Design.

SECOND TERM.

Practical Topography.
 Applied Mechanics.
 Graduation Thesis.
 C. E. Design.

The Mining students will be required to draw the equivalent of two years and the Civil students three.

The courses of study will be rigidly enforced upon all students, candidates for the degrees of the Institution. The degrees awarded are Civil Engineer (C. E.) and Mining Engineer (M. E.).

Certificates and diplomas are issued only at the public commencement.

DEPARTMENTS OF INSTRUCTION.

MATHEMATICS.

PROFESSOR EATON.

Algebra and Geometry are taught by Mr. Clark, and Arithmetic by Mr. Drake.

The practical utility of Mathematics in the arts is the ultimate aim of instruction. While a clear demonstration of every principle involved is required, the application of these principles is made prominent. The solution of a large number of practical examples is required, and the text-books are selected with regard to this practical aspect of the subject.

Their application to the solution of problems is the best method of fixing principles in the memory; and the mental discipline inseparable from such drill is eminently adapted to fit the technical student for future duties.

A thorough training in Mathematics necessarily precedes and is essential to a good knowledge of Engineering. It is pretty generally admitted by engineers, both civil and mining, that students require a thorough course in mathematics before entering the field or office as engineers' assistants to complete their knowledge as practical engineers.—Dr. Bowser.

The aim of the course is to ground the students firmly in the elementary mathematics; so that after graduation they may be able to pursue understandingly and continuously an advanced course of pure and applied mathematics, or to read intelligently advanced works and current literature on engineering.

As the course is progressive, students desiring to take up any subject must present a satisfactory record in subjects appearing above it in the list.

The studies of this department are as follows:

IN THE PREPARATORY COURSE.

JUNIOR YEAR.

First Term.—Arithmetic (completed), Barnes' National by Ficklin, five hours per week.

Second Term.—Algebra (c, beginning), Olney's Complete, to Calculus of Radicals, five hours p week.

SENIOR YEAR.

First Term.—Algebra (b) to Quadratics, five hours per week.

Geometry (b) (Plane), Olney, five hours per week.

Second Term.—Algebra (a) (book completed), five hours per week.

Geometry (a) Solid and Spherical, five hours per week.

IN THE TECHNICAL COURSES.

FIRST YEAR.

First Term.—Trigonometry, Plane and Spherical, Chauvenet, four hours per week.

Second Term.—Analytic Geometry, Plane and Solid, Bowser, four hours per week.

Descriptive Geometry, Church, Part I., four hours per week..

SECOND YEAR.

First Term.—Differential Calculus, (Bowser completed), four hours per week.

Shades, Shadows and Perspective, Church, Part III., two hours per week.

Railroad Curves and Calculation of Earthwork, Searles, for students in Civil Engineering, two hours per week.

Second Term.—Integral Calculus with application to Geometry, Bowser, completed, four hours per week.

THIRD YEAR.

First Term.—Analytic Mechanics, Bowser, four hours per week.

Second Term.—Applied Mechanics, Rankine, four hours per week for students in Civil Engineering.

As elementary Algebra and Geometry lie at the basis of any substantial attainments in mathematics as well as in engineering, great care is taken to secure a thorough mastery of these subjects in the preparatory course.

The course in Rankine's Applied Mechanics has special reference to the Theory of Structures, Strength of Materials, including the more useful and elementary problems in Stress and Elasticity, and Hydrostatics and Hydrodynamics, "Motion of Fluids." Oral and written notes are given to explain difficult and peculiar solutions.

Text-books are not strictly adhered to, but special methods of instruction are used both in supplementing and in substitution for parts of the text.

The Library contains many of the best works on Analytic Geometry, Calculus and Mechanics, which are frequently referred to.

Special arrangements may be made for advanced mathematical study if desired.

GENERAL CHEMISTRY.

PROFESSOR WAIT.

Instruction in this department is given to two classes—the Preparatory, and First Class.

PREPARATORY CLASS.

In this class chemistry is commenced with the second term, and is continued throughout the term. The class is taught the elements of the subject, being fully illustrated by instructive and interesting experiments, and such information is given, aided by suitable text-books, as will prepare them for the higher classes in Chemical Philosophy and Chemical Technology, and also for entering upon laboratory work, which is commenced the following year.

FIRST CLASS.

(Text-books), Chemical Philosophy (Cooke), Chemical Technology (Wagner).

The duties of this class continue throughout the year; there are four recitations each week. Chemical philosophy is first introduced and continued through the first term. The application of Arithmetic to chemistry is given a prominent place in this class. Students are required to perform numerical examples, thereby fitting themselves for the solution of many questions constantly occurring in the advanced department of analytical chemistry.

The second term is given to a course in Chemical Technology. Among the subjects discussed in this course are: Products of Chemical Industry; Glass; Mortars; Cements; Paper; Sugar; Wine making; Oils; Paints; Dyeing and Printing; Bleaching; Gas; Fuel, etc., etc.

ANALYTICAL CHEMISTRY.

PROFESSOR WAIT.

First Year.—Blowpipe Analysis (Elderhorst's Manual); Qualitative Analysis (Fresenius).

Second Year.—Quantitative Analysis (Fresenius); Quantitative Analysis (Fresenius); Assaying (Mitchell).

Third Year.—Quantitative Analysis (Fresenius).

Instruction in this Department is thoroughly practical, and extends throughout the first, second and third years.

FIRST CLASS.

The students in this class spend four hours each day at practical work; each one is provided with a working table, apparatus and chemical reagents.

The course is begun with blowpipe work; the student is made acquainted with the reaction of known bodies, and he is then required to perform the experiments for himself, thus becoming familiar with the behavior of such bodies before the blowpipe, and enabling him to detect the composition of substances given to him for identification.

Qualitative analysis is also taken up, and is taught by lectures and experiments, the student being required to repeat at his working table the tests for bases and acids which have been shown to him. After passing through a systematic course of qualitative analysis, he is required to analyze and report upon substances, including mixtures of salts, also alloys, ores of lead, copper, zinc, antimony, iron, etc., etc., soils, insoluble silicates and mineral waters.

SECOND AND THIRD CLASSES.

Quantitative analysis constitutes the work of these classes. Those students who have completed satisfactorily the work given to them during the first year, and who have passed a practical examination, lasting one week, are allowed to commence quantitative analysis.

The quantitative course includes analyses, either partial or complete, of the following series, each estimation being, at least, duplicated:

(1) *Zinc Sulphate*; (2) *Barium Chloride*; (3) *Alum*; (4) *Chrome Alum*; (5) *Sulphate of iron and Ammonia*; (6) *Blue Vitriol*; (7) *Calcite*; (8) *Calamine*; (9) *Galena*; (10) *Chalcopyrite*; (11) *Orthoclase*; (12) *Kaolin*; (13) *Hematite*; (14) *Pyrolusite* and *Chlorine*, valuation; (15) *Soda Ash*, valuation; (16) *Bleaching Powder*, valuation; (17) *Cerussite*; (18) *Smithsonite*; (19) *Blende*; (20) *Coal*, proximate; (21) *Coal*, ultimate and heating power; (22) *Stibnite*; (23) *Realgar*; (24) *Blast Furnace Slag*; (25) *Lead Furnace Slag*; (26) *Pig Iron*; (27) *Bismuth Litharge*; (28) *Commercial lead*; (29) *Spelter*; (30) *Regulus*; (31) *Beryle*; (32) *Illmenite*; (33) *Chromite*; (34) *Salt-petre soil*; (35) *Mineral Water*.

Besides this course there is the usual practice in the fire assay of the ores of lead and silver, of argentiferous and auriferous native compounds and artificial products, and in the docimastic valuation of the ores of the most prominent metals.

A short course in quantitative blowpipe analysis is required. Also a course in determinative mineralogy.

Special students may pursue, at their discretion, the study and analysis of any class of ores or metallurgic products. Young men, who have neither the time nor means to spare to take the full course, may accomplish much in the way of chemical analysis by devoting their entire time to it during the course of a single year.

*Those in italics are *partial* analyses.

THE NEW CHEMICAL LABORATORY.

The new Chemical Laboratory has been in use one year, and has been found satisfactory in every respect. It was planned and built solely with reference to the work in the school, and the entire building is used by the Chemical Department.

In this building there are the following apartments: The quantitative laboratory; the qualitative laboratory; director's laboratory; lecture room; assay laboratory and weighing room; a quantitative and qualitative evaporating room; preparation room; a supply room, and two basement rooms.

Facilities for securing heat, light and ventilation are very perfect, ample provision is also made for carrying off foul and dangerous gases. All parts of the building are thoroughly and judiciously equipped, nothing has been left undone to make this laboratory one of the most complete in the country.

Students who enter this department will have every facility offered them for doing chemical and metallurgic work under the most favorable and satisfactory conditions possible. In order that the friends of the school may see for themselves, they are particularly invited to visit this new building.

A circular giving a complete and detailed description of this laboratory has been issued, and will be mailed to any one applying for it.

METALLURGY.

PROFESSOR WAIT.

The instruction in this department is given by lectures, supplemented by laboratory practice, and is illustrated by diagrams, models and specimens. The course is introduced by zinc, and is followed by lead, silver, nickel, mercury, copper, iron, antimony and gold. The principles of furnace construction, of slag formation, and of general metallurgical operations, are discussed throughout the course, and special illustrations are given of all the methods described. The students are required to solve problems involving the discussion of the desirable methods of treatment of ores of stated composition, under given economical conditions, and to accompany the solution with plans and estimates for works to carry

out the method. In the lectures and other exercises of this department, full cognizance is taken of the peculiar economic conditions surrounding metallurgical industry in this country, and especial reference is had to the staple metallic products of Missouri—iron, lead and zinc. Studies are made of the local iron establishments, and excursions are made to other iron works, as well as to those at which lead and zinc ores are practically treated.

GEOLOGY AND MINERALOGY.

In the second year, the students have recitations, lectures and laboratory exercises, in the determination of a series of fifty-five well selected mineral species, with special reference to the ores of the metals and their associated gangues. These exercises are followed by lectures and recitations (based on Dana's Manual) on dynamical and historical geology. The lectures on Lithology, and on mineral veins and ore deposits, together with an account of the chief geological features and modes of occurrence in the principal mining districts, complete the course.

CIVIL ENGINEERING.

PROFESSOR EMERRSON.*

In this department, practical work in the field forms a prominent feature. The use of instruments in the field, by the students of Civil Engineering, begins with the second year, and is continued through the remainder of the course. A complete familiarity with the manipulation of all the instruments in common use by engineers and land surveyors, is taught to the students by systematic practice, in the room and in the field. He is made familiar with the chain and its capabilities; the needle compass, the solar compass, the transit instruments, the leveling instrument, the sextant, the plane table, the barometer, and the various tools used in drawing and plotting. Half of each day for one term is devoted to practice in the field, and where necessary, a long time is taken for excursions to the mines, furnaces, bridges and railroad constructions of the country.

The field practice consists of land and railroad surveying, by all the methods in use. Tracts of land, roads and streams are surveyed and plotted; contours of the adjacent country are made with the leveling instrument, the barometer, etc.;

* Resigned.

railway curves are calculated and set out upon the ground, earthwork is measured and estimated from the embankments and excavations of the railroad. A general system of triangulation of the country about Rolla, is begun from a base line carefully laid by the students, which will be extended from time to time for their instruction.

Such parts of astronomy as relate to land surveying or engineering, are carefully studied, and are illustrated by stellar and solar observations.

A general course of descriptive engineering, on the basis of Mahan's Civil Engineering, revised, by Professor Wood, runs through the second term of the second year.

Gillespie's treatise upon Roads and Railroads, and Huntington's Road Master's Assistant, form two of the studies of the Engineering course.

DRAWING.

MR. CLARK.

During the preparatory course the students are instructed and drilled in free-hand drawing and the elements of geometrical drawing. The freehand includes drawing in outline and shading, both from copy and model, with pen and pencil. The geometrical drawing includes practice in the use of instruments, elementary projection drawing and some practice in lettering.

Instruction in crayon and water-colors is provided for those who show themselves able to profitably take such work.

During the technical course the instruction in drawing embraces the following subjects:

First Year.—Topography, Lettering and Mechanical Drawing.

Second Year.—Problems in Projection drawing, Stereotomy, Masonry and Machine drawing.

Third Year.—Engineering drawing and Practical Topography.

During the first year the student is exercised in lettering in order to acquire a rapid and neat system of letter formation. The topographical and mechanical drawings are neatly finished in ink, and the latter are appropriately colored to represent the different materials employed.

In the second year exercises are given in the construction of problems in descriptive geometry, and in shades, shadows and perspective. The problems are drawn with pen and India ink, and are constructed on mathematical principles, displaying all the difficult problems of the intersection of curved surfaces, and the representations of warped surfaces having two or three directrices.

The drawing during the second and third year consists in the solution and complete representation on paper of practical problems, such as the draughtsman meets in practice. Neatness and accuracy of execution, as well as a thorough familiarity with each of the subjects, is required.

MINE ENGINEERING.

PROF. EMERSON.

This is taught entirely by lectures. The subjects of system and attack and exploitation of mineral deposits; of shafts, adits and levels; timbering of mines; subterranean transportation, hoisting, pumping, surface transportation, and mechanical concentration, are considered in elaborate detail.

The course is fully supplemented by extended field practice, the important parts of the civil engineering course, and by extended instruction in assaying and analytical chemistry, and in drawing plans and sections of mines and practical work.

MECHANISM.

PROFESSOR EMERSON.*

An extended series of lectures is given upon this important subject, which is intended to be a descriptive epitome of the principles which govern, and the forms and mode of construction of machines used in industrial pursuits, embracing prime movers, machines of transmission, and as much as is possible in the course of applied machinery.

STEAM ENGINE.

A series of lectures is given, historical, descriptive and theoretical, of the steam engine, embracing all the varieties in use, and their special applications.

FEES, EXPENSES, ETC.

The fees for instruction, etc., at the School of Mines and Metallurgy, are the same as at the other departments of the University, viz: An annual entrance fee of \$10, besides an assessment of \$5 per term for incidentals and for the use of the library. Special students are subject to the same charges; all laboratory students furnish their own blowpipes, platinum, crucibles and apparatus, silver and gold solutions, and pay for gas and fuel consumed and for apparatus damaged or broken.

* Resigned.

A deposit of \$5 per term, covering the value of the apparatus and chemicals issued, is required to be placed in the hands of the Treasurer by each laboratory student. This deposit, less the value of material consumed, is returned at the close of the year.

The exercises of the drawing room require also a small expenditure, annually, for materials. Text-books and all requisite materials for students can be procured in Rolla, either from dealers, or, in the case of chemical apparatus, from the school, at the usual rates.

A fee of \$5 must be paid, before graduation, for the degree; a fee of \$1 for either the elementary certificate or the academic diploma.

Good boarding, at places approved by the Faculty, can be obtained at from \$3.50 to \$4.00 per week.

The following is a careful estimate of necessary expenses for a college year :

Tuition.....	\$20 00
Contingent expenses for laboratory ...	20 00
Board, fuel, washing and lights from.....	\$96 to 150 00
Books, stationery, etc.....	8 to 20 00

ADMISSION.

Before matriculation or entrance upon the duties of the school, the Treasurer's receipt for entrance fee and for the incidentals of the term [or a statement from the Director that the time of payment has been extended], and also certificates of examination giving the grade made in each study, and signed by the instructor conducting the examination, must be presented to the Secretary of the Faculty.

No student shall be entitled to have his name enrolled on the class register of any instructor, nor be admitted to any class as a member, until he shall have signed his name on the Secretary's book and received a certificate to that effect, stating the course for which he has entered.

All students are requested to present themselves for admission on Monday and Tuesday, September 19th and 20th, 1887.

The collegiate year opens on the third Monday in September. There is no suspension of exercises other than for examination between the two terms of the year.

HISTORICAL, ETC.

The School of Mines and Metallurgy—a department of the University of the State of Missouri—is located at Rolla, Phelps county, on the line of the St. Louis & San Francisco Railroad, one hundred and thirteen miles southwesterly from St. Louis. The locality is pre-eminently healthful, is in the midst of an extensive and rapidly developing iron section, with districts abounding in lead and zinc deposits, within easy access, and thus affords excellent opportunities for the field study of some of the modes of occurrences of the ores of these metals, as well as for the

practical investigation of their methods of treatment. Excursions for such purposes will constitute a prominent feature in the instruction of the advanced classes.

The institution was created by the legislative act of February, 1870, disposing of the Congressional grant of land for agricultural and mechanical colleges. It was formally opened November 23, 1871. The first class, of three members, graduated in June, 1874, having completed the full course. The fifteenth year of the Institution closes with this report.

The design of the School of Mines and Metallurgy, in connection with the Agricultural College, is to carry out, to its amplest extent, the intention of the act of Congress, providing for education in the industrial arts. This has been kept prominently in view in arranging the curriculum of the school, in the selection of its apparatus, in providing its equipment and in the organization of its Faculty. It is a school of Technology, with Civil and Mine Engineering and Metallurgy, as specialties.

The school is furnished with apparatus, instruments, and other appliances for practical instruction and demonstration. It has a supply of excellent surveying, engineering and drawing instruments, physical apparatus, embodying the newest forms for illustration and research, together with diagrams and models for the illustration of metallurgic processes and engineering construction. The new chemical laboratory has been completed and is amply furnished with apparatus and reagents necessary for practical instruction, and for any line of chemical and metallurgical research. The library has been selected with special reference to supplementing the labors of the class and lecture rooms, and consists, therefore, largely of standard reference works on the physical science, mathematics and technology

CALENDAR.

1887.

June 9th, Thursday, 10 A. M.....	Annual Commencement.
September 19th, Monday.....	First Term begins.
September 19th and 20th.....	Entrance Examinations.
December 23rd, Friday.....	Close for Christmas Holidays.

1888.

January 10th, Tuesday, 9 A. M.....	Exercises resumed.
January 23rd, Monday.....	Examinations begin.
January 28th, Saturday.....	Examinations close.
January 31st, Tuesday, 9 A. M.....	Second Term begins.
June 14th, Thursday, 10 A. M.....	Annual Commencement.



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